REMARKS

Claims 1-3, 5, and 8-9 are presented for examination. Claims 4, 6, and 7 have been withdrawn from consideration. The claims have not been amended in this response.

Claims 1 and 5 stand rejected as being anticipated by US 5,280,388 to Okayama et al. or US 5,444,567 to Kataoka. The Examiner's rejections are traversed for the following reasons.

The present invention is directed toward a grating, a replica grating, and toward methods of making a negative grating and a replica grating, respectively. The presently claimed invention is directed toward a grating having a groove cross sectional shape that is formed as either a half-sinusoidal shape or a half-sawtooth form, and wherein the groove bottom has a flat form. It is respectfully submitted that the cited art fails to teach or suggest the structural features of the present invention, as will be apparent from the following discussion.

The Okayama et al. patent (US 5,280,388) is directed toward an optical low-pass filter that is formed from a multi-layer structure and is adapted to generate a phase difference at a boundary of the layers. The layers are selected so as to have, at a selected wavelength, the same refractive index while having different refractive index dispersions.

With reference to Fig. 2, Okayama teaches a layer 8 on the object side, a layer 9 on the image side, and structure 10 for generating a phase difference at the boundary of the two layers 8, 9. The structure 10 is only shown schematically in Fig. 2 and Fig. 8. In this regard, the Examiner is referred to Col. 3, lines 10-11, wherein it

is stated that: "element 3 is a wavelength selective phase grating optical low-pass filter of this invention" and Col. 3, lines 29-34, wherein it is stated that: "In FIG. 2, numeral 8 denotes a layer on the object side; element 9 is a layer on the image plane side, and element 10 is a structure for generating a phase difference formed at the boundary of the two layers, and having a section configuration to have periodicity in the direction of x in the figure." The illustration in Fig. 2 is only schematic, and does not define a particular structure for the "structure for generating a phase difference formed at the boundary of the two layers". Rather, reference must be made to Figs. 3 and 4 for the only examples of the structure 10 provided in the Okayama et al. patent.

Fig. 3 of Okayama shows the structure 10 as being triangular in shape, whereas Fig. 4 of Okayama shows the structure 10 as being trapezoidal in shape. As noted at Col. 4, lines 12-16, "Accordingly, as a configuration of the structure 10 for generating the phase difference, the MFT characteristics on each wavelength band for the case where the configurations as shown in FIG. 3 and FIG. 4 are used are shown in FIG. 5 and FIG. 6, respectively." There is no disclosure or suggestion in the Okayama patent that the structure 10 be anything other than what is shown in FIG. 3 or FIG. 4. Accordingly, the Examiner's assertion that Okayama teaches a grating having groove shaped as a half-sinusoidal wave, as required by the present invention, is in error.

Accordingly, with reference to claim 1 and claim 5, the Okayama patent does not teach or suggest that the groove cross section shape is a half sinusoidal wave. Rather, Okayama only teaches a groove having a triangular or trapezoidal cross section shape. Thus, reconsideration and withdrawal of the rejections based upon

Okayama is requested.

Moreover, it is noted that Fig. 2 of Okayama has a two-layer structure, which is different than the present invention. It is further noted that the grating of claim 1 has a higher diffraction efficiency than gratings of other groove shapes in a wide wavelength range, especially in a resonance region, and shows a high efficiency with balanced diffraction efficiencies in both of TE and TM. The grating of the present invention, as compared to known gratings, has a high efficiency at the same wavelength for polarized lights. For example, where the number of grooves is 900/nm and the wavelength is 1.55 μm, TE polarized light (P polarized light, which is parallel to the groove) and TM polarized light (S polarized light, which is perpendicular to the groove) are the same, and the maximum efficiency for the diffraction efficiency in case of the grating with sinusoidal wave groove is 42% (deepness: 675 nm) in both one TE and TM. However, with the asymmetric structure of the half sinusoidal wave groove (duty ratio 0.5) according the present invention, the maximum efficiency is 68% in both TE and TM.

Kataoka teaches a light control device including a diffraction grating. The grating is shown schematically in Figs. 7, 8, 9 and 12 of Kataoka. There is no description in Kataoka of the shape of the diffraction grating.

It is submitted that the illustration of the grating in Fig. 7, 8 and 12 is schematic in nature, and cannot be taken literally. For example, it would be clear to one skilled in the art that the size of the grating lines is such that they will not be visible in the manner depicted in Figs. 7, 8 and 12. Rather, in order to show 'something' when preparing these figures, the illustrator added 'bumps' to the figures as representing the grating lines. In this regard, please compare the 'gratings' of

Figs. 7 and 8 with those of Fig. 9.

Clearly, Kataoka is not directed toward a particular grating structure, but merely uses the grating as an alternative to the prism. Accordingly, the Kataoka patent can only properly be cited for teaching that the prism structure and the grating may be interchangeably used in the application as a light control structure.

It is submitted that, due to the complete lack of disclosure, the Kataoka grating can only be interpreted as being some already known (i.e., conventional) grating structure. Kataoka may not properly be cited for teaching a particular grating structure because Kataoka is silent as to the shape of the grating, which is the subject of the present invention.

It is further noted and emphasized that Kataoka does not teach that the grating has a half-sinusoidal or a half-sawtooth shape. It is noted that grating structures are precisely formed, and that one skilled in the art could not reasonably deduce from the Kataoka disclosure, when viewed in total, that Kataoka has taught or suggested a grating having "groove cross section shape is a half sinusoidal wave and said groove bottom part is shaped as a flat form" as required by claim 1 (similar language used in claim 5). There simply is no disclosure to support the Examiner's conclusions. Accordingly, for at least the foregoing reasons it is submitted that claims 1 and 5 are not anticipated by Kataoka. Reconsideration and withdrawal of the rejections based upon the Kataoka patent is requested.

Claims 3, 5, 8 and 9 stand rejected as being anticipated by US 6,099,146 to Imamura. The Examiner's rejections are traversed for the following reasons.

The Imamura teaches a diffraction grating that may have one of a series of different groove cross sectional shapes. Fig. 1a teaches a rectangular or square

wave shape; Fig. 1b teaches a triangular shape; Fig. 1c teaches a trapezoidal shape; Fig. 1d teaches a sawtooth shape. None of these shapes is a "half sawtooth shape" as required by claim 3 and 5.

In this regard it is noted that the Examiner has concluded that a square or trapezoidal shape is the same as a 'half sawtooth shape". It is submitted that this conclusion is clearly in error.

Assuming that the terms are given their ordinary meaning, it is considered apparent that each of the terms "square wave shape" and "trapezoidal shape" and "half sawtooth shape" have a definite meaning in the art. It is further submitted that these terms have completely different meanings, and one skilled in the art would never consider a "square wave" or "trapezoid" as being equivalent to a "half sawtooth". Thus, it is respectfully submitted that Imamura does not teach that for which it is cited and clearly does not teach the invention defined in claims 3 and 5, from which claims 8 and 9 depend.

The Examiner has stated that "The saw tooth recitation does not distinguish from a square or trapezoidal tooth since no structure distinguishing it there from is recited." Applicant respectfully disagrees. The recitation of a "said groove cross section shape is a half sawtooth wave and said groove bottom part is shaped as a flat form" does, indeed, structurally distinguish the claimed grating from the "square" or "trapezoidal" shape of Imamura. In light of the foregoing, reconsideration and withdrawal of the rejections based upon the Imamura patent is requested.

Further, if the Examiner intends to maintain the rejections of claims 3, 5, 8, and 9 based upon the Imamura patent, the Examiner is asked to provide the applicant with some basis for equating the square and trapezoidal shapes taught by

Imamura with the half-sawtooth shape defined in claims 3 and 5.

Claim 2 stands rejected as being unpatentable over Okayama or Kataoka in view of Imamura. The Examiner's rejection is traversed for the following reasons.

As noted above, none of the cited references teach or suggest the invention defined in claim 1, from which claim 2 depends. Therefore, even if the references were combined as advocated by the Examiner, the invention defined by claim 2 would not result.

Further, the Examiner has not identified any suggestion or motivation to support the proposed combination of references. It is submitted that the mere fact that a better product may result from the combination is not sufficient, under US patent law, to support the combination. It is considered apparent that the present application provides the only motivation for the combination of references and, as such, the rejection of claim 2 based upon this combination is invalid for hindsight and should be withdrawn.

In light of the foregoing, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in a condition for allowance, the Examiner is invited to initiate a telephone interview with the undersigned attorney to expedite prosecution of the present application.

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 18-0160, our Order No. NGB-12833.

Respectfully submitted,

RANKIN, HILL, PORTER & CLARK LLP

By _____
David E. Spaw, Reg. No. 34732

4080 Erie Street
Willoughby, Ohio 44094
(216) 566-9700